Catalogue of American Amphibians and Reptiles.

McCleary, R.J.R. and R.W. McDiarmid. 1993. *Phyllorhynchus decurtatus.*

Phyllorhynchus decurtatus (Cope) Spotted Leaf-nosed Snake

Phimothyra decurtata Cope, 1868:310. Type-locality, "Upper part of Lower California," Baja California Norte, México. Holotype, Academy of Natural Sciences of Philadelphia (ANSP) 5489, an adult female collected by William M. Gabb, specific date of collection 1867 (see Nelson, 1922) (examined by authors).
Phymothyra decurtata: Garman, 1884a:39.
Salvadora decurtata: Garman, 1884a:39.
Phyllorhynchus decurtatus: Stejneger, 1890:154.
Lytorhynchus decurtatus: Boulenger, 1893:417.

• **Content.** Five subspecies are currently recognized: *decurtatus, arenicola, norrisi, nubilus,* and *perkinsi.*

• **Definition and Diagnosis.** A species of Leaf-nosed Snake with a large rostral plate completely separating the internasals, and with a higher number of dorsal blotches (18-60 body and 2-15 tail) compared to *P. browni.* The head is slightly distinct from the neck. Ratios of tail/body length vary from 11.2-23.1% in males and 8.0-11.2% in females. Males are larger (510 mm maximum total length) than females (486 mm). See the generic account for details of head and body scutellation. Ventrals number 151-187 in males, 165-196 in females. Paired subcaudals number 29-42 in males, 20-34 in females. The cloacal scute is entire.

Dorsal ground color ranges from cream, yellow, or pale pink to beige, pale brown, or pale gray. Lateral spots are usually present in one or more, sometimes irregular, rows. A dark band passes between the eyes and laterally on the head from the eyes to the angle of the mouth. Dorsal blotches, lateral spots, and eye bands are creamy brown to pale chocolate brown. Blotches are irregular, often darker along the margins and paler in the centers.

• **Descriptions.** The original description of *P. decurtatus* was given by Cope (1868); those of other subspecies are presented below under their respective accounts. Other detailed descriptions were given by Stejneger (1890), Cope (1900), Van Denburgh (1922), Klauber (1935, 1940), Bogert and Oliver (1945), Smith and Langebartel (1951), and Wright and Wright (1957). Briefer accounts reporting new specimens, details on morphological characters and coloration, and similar descriptive information are included in papers by Garman (1884a), Cope (1892, 1900), Boulenger (1893), Brown (1901), Ditmars (1907, 1939, 1951), Atsatt (1921), Van Denburgh and Slevin (1921), Schmidt (1922), Klauber (1924, 1932, 1934), Medden (1927), Linsdale (1932, 1933), Taylor (1936), Schmidt and Davis (1941), Pickwell (1947), Perkins (1949a), Hensley (1950), Cliff (1954a, 1954b), Langebartel and Smith (1954), Stebbins (1954, 1966, 1972, 1985), Murray (1955), Zweifel and Norris (1955), Cagle (1957), Smith and Hensley (1958), Leviton and Banta (1964), McCoy (1964), Miller and Stebbins (1964), Fowlie (1965), Hardy and McDiarmid (1969), Tanner (1969), Cochran and Goin (1970), Bostic (1971), Leviton (1971), Marx and Rabb (1972), Powers and Banta (1974), Behler and King (1979), Campbell and Christman (1982), and Obst et al. (1988).

• **Illustrations.** Photographs of *Phyllorhynchus decurtatus* (without subspecific designations) were presented by Bogert (1939), Schmidt and Davis (1941), Miller and Stebbins (1964), Behler and King (1979, color), and Yingling (1991). Photographs of subspecies

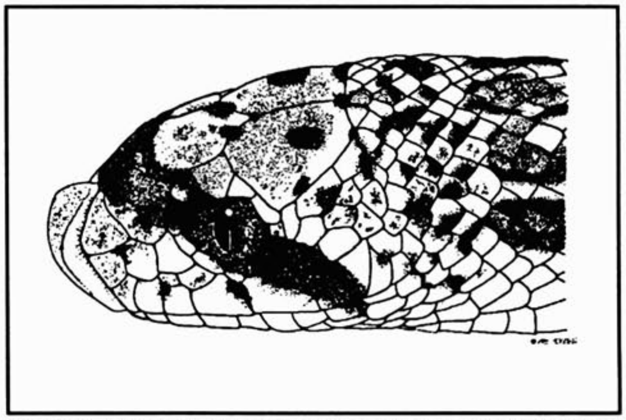


Figure 1. The head of the holotype of *Phyllorhynchus decurtatus* (ANSP 5489, an adult female).

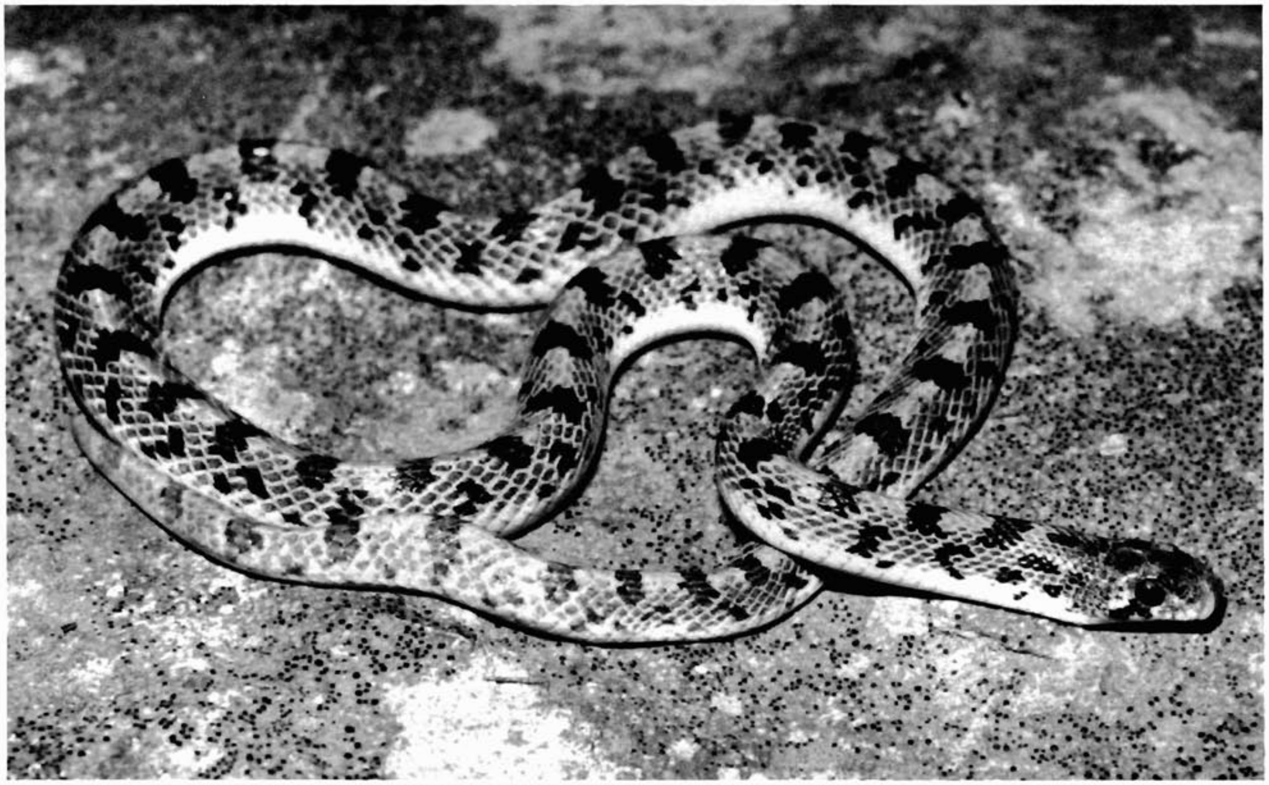
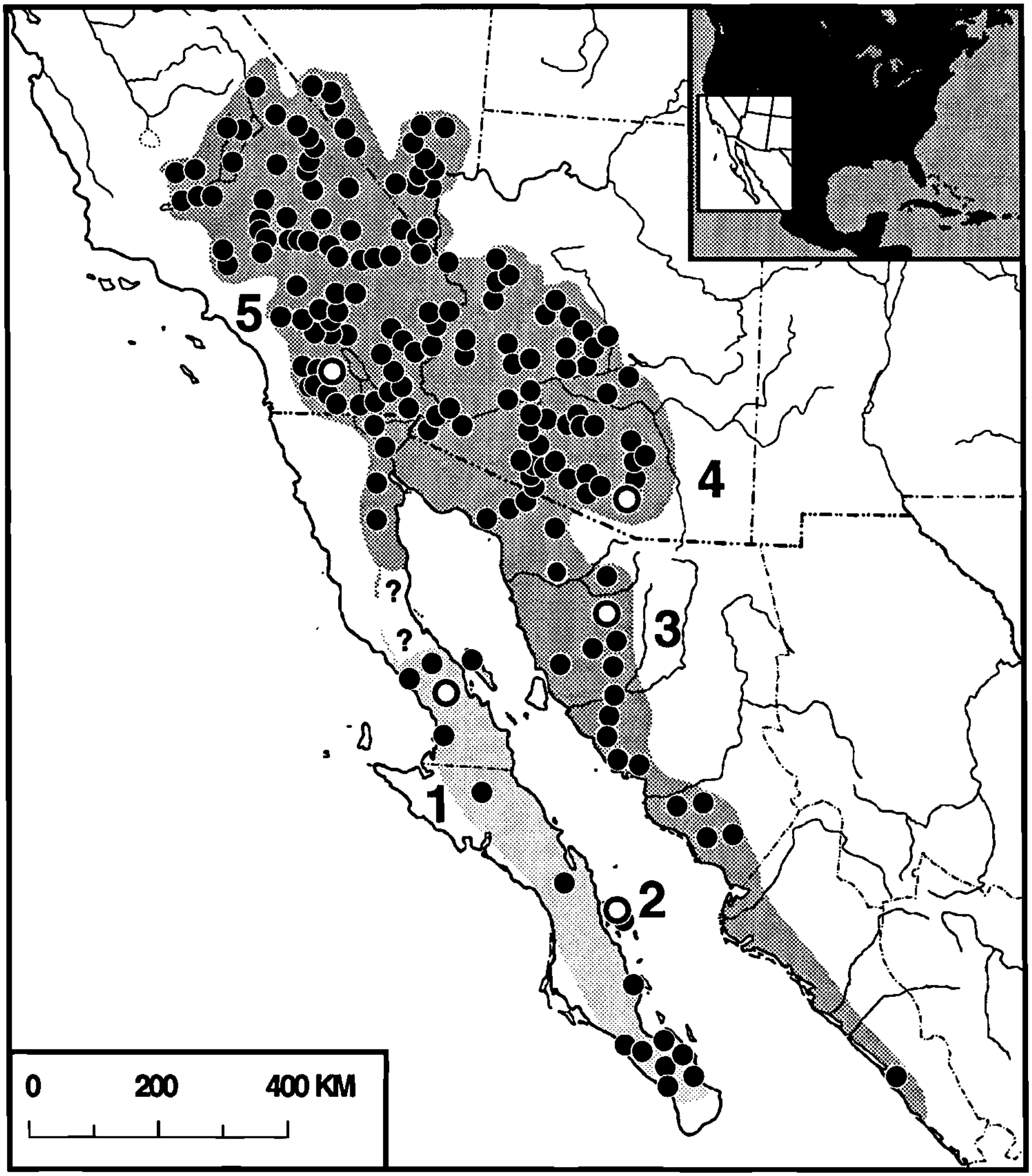


Figure 2. *Phyllorhynchus decurtatus perkinsi* from Kern County, California (photograph by R. Wayne Van Devender).

were published for *decurtatus* by Klauber (1935) and Powers and Banta (1974, as *P. d. porelli*); for *nubilus* by Klauber (1940), Wright and Wright (1957), and Fowlie (1965); for *perkinsi* by Klauber (1935), Ditmars (1939), Pickwell (1947), Perkins (1949a), Fowlie (1965), Shaw and Campbell (1974, color), and Coborn (1991, color). Cope (1900), Stebbins (1954, 1966, 1972, 1985), Allyn (1956), and Simon (1979) included illustrations of *P. decurtatus* in their works. A drawing of *P. d. perkinsi* is in the field guide by Schmidt and Davis (1941). Bogert and Oliver (1945) included an illustration of the right maxilla of *P. d. perkinsi*, and Cowles (1941) showed a photograph of *P. d. perkinsi* tracks in sand. A photo of an everted hemipenis of a *P. d. perkinsi* was published in Klauber (1935).

• **Distribution.** *Phyllorhynchus decurtatus* is found in dry, desert environments from Inyo County, California, southern Nevada, and southcentral Arizona in the north to near the tip of Baja California and Mazatlán, Sinaloa in the south. The species has also been collected on islands in the Gulf of California, including Angel de la Guarda, Cerralvo, Monserrate, San José, and San Marcos. We assume that a single specimen (MVZ 171759) collected on Corral Hollow Road, Castle Butte, San Joaquin Co., California was an escaped or released individual. This locality is well outside the known range of the species and in a habitat not occupied by the species elsewhere. Most collection records come from specimens that were either captured alive or found dead on the road. Klauber (1935) noted that



Map. Distribution of the Spotted Leaf-nosed Snake, *Phyllorhynchus decurtatus*. Type-localities of subspecies are shown by large, open circles. Other known localities are marked by solid circles (some symbols, especially in parts of California and Arizona, may represent more than one record). Question marks note the hiatus in Baja California. Ranges of *P. d. norrisi*, *P. d. nubilus*, and *P. d. perkinsi* are not distinguished due to uncertainty in the allocation of specimens from certain areas in southcentral Arizona and northern Sonora (see text). Fossil sites are indicated by stars on the generic map (account no. 579).

until collecting by automobile at night was realized as being useful, the Leaf-nosed Snake was thought to be rare. Gaps in the distributional range often stem from lack of roads in those areas or unsuitable habitat adjacent to roads.

Published distributional records for *P. decurtatus* other than those in checklists or cited elsewhere are by Nelson (1922, Baja California), Klauber (1931, southern California border area), Slevin (1931, Inyo County, California), Mosauer (1936, Baja California), Brattstrom (1953, Borrego Desert, San Diego County, California), Langebartel and Smith (1954, Sonora), Neill (1958, Sonora and Isla Monserrate, Gulf of California), Turner and Wauer (1963, Inyo County, California), Lowe (1964, Arizona), Soulé and Sloan (1966, Isla San José and Isla Angel de la Guarda, Gulf of California), Hahn and May (1972, Mohave and Yavapai counties, Arizona), Vitt and Ohmart (1978, Lower Colorado River), Welsh and Bury (1984, southern Colorado Desert, Baja California), and Welsh (1988, northern Baja California).

• **Fossil Record.** Van Devender and Mead (1978) reported vertebrae from five Early Holocene sites from fossil packrat middens in Arizona. Holman (1981) included these records in his review of North American Pleistocene snakes.

• **Pertinent Literature.** The name *Phyllorhynchus decurtatus*, or one of its synonyms or subspecies, has been included in checklists (other than indicated previously) by Cope (1875, 1887), Yarrow (1882), Garman (1884b), Belding (1887), Van Denburgh (1895), Stejneger and Barbour (1917, 1923, 1933, 1939, 1943), Cuesta Terrón (1920), Klauber (1930), Slevin (1931), Cowles and Bogert (1936), Smith and Taylor (1945), Wright and Wright (1952), Schmidt (1953), Conant et al. (1956), Cagle (1957), Gates (1957), Lindsay (1964), Banta (1965), Smith and Smith (1976), Murphy (1983), Banks et al. (1987), and Collins (1990). Citations of *P. decurtatus* contained exclusively in keys were by Blanchard (1925), Perkins (1940, 1949b), and Savage (1948, 1949). Atsatt (1923) described various aspects of the behavior of a captive specimen and made observations on locomotion and response to stimuli; attempts to feed the snake were unsuccessful. Other behavioral observations were reported by Klauber (1939, activity), Cowles (1941, wintering habits), Brattstrom (1953, activity and defense) and Greene (1988, antipredator mechanisms). Statistical treatments of variation in morphological traits were discussed by Klauber (1941a, 1941b, 1943, 1945) and Kerfoot (1969, 1970). Thermal limits and the effects of temperature on activity were discussed by Atsatt (1923), Bogert (1939), Cowles and Bogert (1944), Saint-Girons and Saint-Girons (1956), and Spector (1956). Type-specimens of *P. decurtatus* in museum collections were listed by Peters (1952), Leviton and Banta (1956), Cochran (1961), Smith et al. (1964), Sloan (1965), and Kluge (1984). Weaver (1965) and Underwood (1967) mentioned a peculiar osteological trait associated with the border of the foramen magnum, and Van Devender and Mead (1978) described vertebral characters for the species. The only record of an albino specimen was mentioned by Brattstrom (1953), Klauber (1956), and Hensley (1959). Klauber (1943) demonstrated a striking dimorphism in the proportion of tail to total length between males and females in a single population. Bury et al. (1970), Trinco and Smith (1972), and Baker et al. (1972) described the karyotype (2N=36), and Bury et al. (1970) published a photograph of a metaphase spread. Murphy and Ottley (1980) used electrophoresis to evaluate the relationships between *P. decurtatus arenicola* and *P. d. decurtatus*. *Phyllorhynchus decurtatus* is oviparous; clutch size and reproductive season were discussed by Brattstrom (1953) and Fitch (1970). Ditmars (1912) speculated on food habits, but the only verified prey items are lizard eggs and a small specimen of *Coleonyx variegatus* (Klauber, 1935; Dial et al., 1989); eggs, probably of *Coleonyx*, and lizards, based on legs of a small *Callisaurus* (Brattstrom, 1953); and squamate eggs and the lizards *Coleonyx variegatus* and *Callisaurus draconoides* (Peter Thule and Harry W. Greene, pers. comm.). Perkins (1949a) reported that small specimens of *P. d. perkinsi* tear off and eat gecko tails. The remains of unidentified Hymenoptera (Brattstrom, 1953) may have been in the stomach of a lizard eaten by the snake. No verifiable records of insects as prey are known (see Atsatt, 1923; Harry W. Greene, pers. comm.). Known predators include the snakes *Arizona elegans* (Klauber, 1935), *Crotalus s. scutulatus* (in a collecting bag), and *C. viridis oreganus* (in captivity) (Klauber, 1956). Vitt and Hulse (1973) reported that captive *Micruroides euryxanthus* refused specimens of *P. decurtatus* when offered. Greene (1988) summarized references on antipredator behaviors. Dial et al. (1989) used *P. decurtatus* as a potential predator in their study of chemosensory detection by *Coleonyx variegatus*. Klauber (1935) reported mites on specimens of *P. decurtatus*. Savage (1960) discussed dispersal patterns in his paper on the evolution of the Baja California herpetofauna, and Murphy (1983) suggested that the species possibly dispersed over water to some of the islands in the Gulf of California. Seib (1980) pointed out the nearly continuous distribution of *P. decurtatus* in the peninsula of Baja California.

• **Etymology.** The species name *decurtatus* is derived from the Latin *decurto*, meaning to cut short. In his original description Cope (1868) commented that both "... the head is shortened ..." and "... the tail is relatively shorter ...." The subspecific names are derived as follows: *perkinsi* is a patronym to honor Charles B. Perkins, a colleague and friend of Laurence M. Klauber who described that taxon; *nubilus* is a Latin word meaning cloudy, presumably in reference to the nature of the irregular blotches that cover the body; *norrisi* is a patronym to honor Lester J. Norris, who gave financial support to the expedition that collected the type-specimen; *arenicola* is derived from the Greek *arena*, meaning sand, and cola, meaning dwelling; presumably in reference to the fact that the type-series was collected on sand dunes on Isla Monserrate.

• **Remarks.** Although the subspecies of *Phyllorhynchus decurtatus* listed below are those currently recognized, we have doubts as to the distinctiveness and hence validity of some (perhaps most) of the named populations. For example, specimens identified as *P. d. perkinsi* and *P. d. nubilus* seemingly overlap in parts of their range in southern Arizona. Hensley (1950) reported intergrades between *P. d. perkinsi* and *P. d. nubilus* in southern Pima County, Arizona and *P. d. nubilus* from adjacent northwestern Sonora. Smith and Langebartel (1951) suggested that the same *P. d. nubilus* specimens were more likely intergrades between *P. d. perkinsi* and *P. d. norrisi*. Seven years later, Smith and Hensley (1958) continued to refer to snakes from this region as intergrades between *P. d. perkinsi* and *P. d. nubilus*. Maps published by Fowlie (1965) showed overlap in the ranges of *P. d. nubilus* and *P. d. perkinsi* in areas of western Pima and southern Maricopa counties, Arizona. Stebbins (1985) depicted a distribution north of the range of *P. d. nubilus* and east of *P. d. perkinsi* in the same way he depicted the range of *P. d. norrisi*. We suspect that Stebbins was attempting to show areas of presumed intergradation between *P. d. nubilus* and *P. d. perkinsi*, but we are unsure. A detailed review of geographic variation in the Spotted Leaf-nosed Snake, *P. decurtatus*, is long overdue. Once this variation is understood, researchers will be able to determine which subspecies, if any, are deserving of taxonomic recognition.

Little to no information is available concerning the breeding habits of *P. decurtatus*, as they apparently have not been successfully maintained or bred in captivity. What captive records exist (Atsatt, 1923; Vorhies, 1926; Yingling, 1991) describe these snakes as refusing food, and most specimens apparently dying shortly after capture.

One nomenclatural problem has plagued the literature for some time. Many authors have mistakenly used the name *nubilis* (Latin for marriageable) instead of *nubilus* (Latin for cloudy) for *P. d, nubilus* Klauber. We estimate that more than half of the references since 1940 that have treated this taxon have used *nubilis* rather than *nubilus*. Smith and Smith (1976) even indicated a preference for *nubilis*, and some references (Schmidt and Davis, 1941; Stebbins, 1954) have used both spellings in the same publication. A recent, supposedly authoritative list of scientific names has continued to perpetuate the erroneous use of *nubilis* through three editions (Collins et al., 1978; Collins et al., 1982; Collins, 1990). Even in the original description (Klauber, 1940), *nubilis* appeared once ("Like other species of *Phyllorhynchus*, *nubilis* hisses and strikes when annoyed..."). This is clearly an inadvertent error, because Klauber explicitly named the subspecies *nubilus* and used that spelling in the heading of the description, in the key, in the caption of the photograph of the holotype, on the range map, and at least 14 other times in the paper. Also, in the original description of *P. d. nubilus*, Klauber (1940:197) referred to the subspecies as the "Cloudy Leaf-nosed Snake." Clearly *nubilus* is the correct original spelling and should be used forthwith to refer to *Phyllorhynchus decurtatus nubilus*.

1. *Phyllorhynchus decurtatus decurtatus* (Cope) Baja California Leaf-nosed Snake

Phimothyra decurtata Cope, 1868:310. See species synonymy.

Phymothyra decurtata: Garman, 1884a:39.
Salvadora decurtata: Garman, 1884a:39.
Phyllorhynchus decurtatus: Stejneger, 1890:154.
Lytorhynchus decurtatus: Boulenger, 1893:417.
Phyllorhynchus [decurtatus] [decurtatus]: Linsdale, 1933:222 (part). First use of present combination. See Comment below.
Phyllorhynchus decurtatus decurtatus: Klauber, 1935:9.
Phyllorhynchus decurtatus decurtatus: Smith and Taylor, 1950:322. Type-locality restricted to México: Baja California; "San Fernando Misión (between San Ignacio and)."
Phyllorhynchus decurtatus porelli Powers and Banta, 1974:241. Type-locality, "southwest Cerralvo Island, Gulf of California," Baja California Sur, México. Holotype, Natural History Society of Maryland (NHSM) R1800, a subadult male collected by Ismael Avilés on 15 January 1973 (not examined by authors).
Phyllorhynchus decurtatus porelloi: Smith and Smith, 1976:13-14. Correction of incorrect original spelling.

• **Diagnosis.** This subspecies of Spotted Leaf-nosed Snake is distinguished by ventral scale counts of 157-167 in males and 167-176 in females; subcaudals 33-36 in males, 22-26 in females; and dorsal body blotches 18-33 with 2-8 tail blotches. The geographic range extends from southern Baja California Norte to near the southern tip of Baja California Sur, including San Marcos, San José and Cerralvo islands in the Gulf of California.

• **Comment.** Linsdale (1933) reported a specimen from Alamo Muerto, Sonora, México as *Phyllorhynchus decurtatus browni.* This action, though based on a misidentification, constituted the first reference to subspecies of *P. decurtatus.* In fact, the specimen (MVZ 10170) is not referable to *P. browni* Stejneger, but is a specimen of *P. decurtatus* (Cope). Klauber (1940) placed Linsdale's citation in the synonymy when he described *P. decurtatus nubilus.* In the same paper Klauber implied that the specimen was intermediate between *P. d. nubilus* and *P. d. decurtatus,* and further commented that the specimen, together with three others from near Guaymas, Sonora, may represent another subspecies. Smith and Langebartel (1951) included the Alamo Muerto specimen as a "hypoparatype" of their *Phyllorhynchus decurtatus norrisi.* Nelson (1922) indicated that William M. Gabb collected in Baja California in 1867; an itinerary of that exploration was published in Browne's (1887) Resources of the Pacific Slope (cited in Nelson [1922], not seen by authors).

2. *Phyllorhynchus decurtatus arenicola* Savage and Cliff Monserrate Leaf-nosed Snake

Phyllorhynchus arenicola Savage and Cliff, 1954:69. Type-locality, "the southwest coast of Isla Monserrate, Gulf of California, Mexico." Holotype, California Academy of Sciences (CAS-SU 14013), an adult male collected by Frank S. Cliff, John P. Figg-Hoblyn, Jon M. Lindbergh, and Jay M. Savage on 15 April 1952 (examined by authors).
Phyllorhynchus decurtatus arenicola: Wright and Wright, 1957:2. First use of present combination.
Phyllorhynchus decurtatus arenicolus: Smith and Smith, 1976:S-B-159; S-C-50. Confusing first use of incorrect spelling.
Phyllorhynchus decurtatus arenicolus: Murphy and Ottley, 1980:263. First clear use of incorrect spelling.

• **Diagnosis.** This subspecies of Spotted Leaf-nosed Snake is distinguished by ventral scale counts of 164 in males and 172 in females; subcaudals 39 in males, 31 in females; and dorsal body blotches 30-32 with 6-7 tail blotches. Geographically this taxon is known only from Isla Monserrate.

• **Comment.** Although Savage and Cliff (1954) originally described the snake as a species, subsequent publications made use of the name as either a species or a subspecies. Murphy and Ottley (1980) used electrophoretic methods to determine that the snake was not a separate species, but was distinct enough to warrant designation as a subspecies. Their data were the first to evaluate the status of the taxon. Some authors have referred to this snake as *Phyllorhynchus decurtatus arenicolus;* this is an error as the name *arenicola* was originally used as a noun in apposition (not as an adjective or modifier) and therefore the taxon retains the original spelling.

3. *Phyllorhynchus decurtatus norrisi* Smith and Langebartel Sonoran Leaf-nosed Snake

Phyllorhynchus decurtatus browni: Linsdale, 1933:222 (part).
Phyllorhynchus decurtatus nubilus: Klauber, 1940:197 (part).
Phyllorhynchus decurtatus norrisi Smith and Langebartel, 1951:181. Type-locality, "45.1 miles south of Santa Ana, Sonora," México. Holotype, University of Illinois Museum of Natural History (UIMNH) 23887, a subadult male collected by David A. Langebartel and R. Abbuhl on 3 July 1951 (examined by authors).

• **Diagnosis.** This subspecies of Spotted Leaf-nosed Snake is distinguished by ventral scale counts of 151-156 in males and 166 in females; subcaudals 29-34 in males, 20-24 in females; and dorsal body blotches 23-42. This taxon has been reported from scattered localities in central and southern Sonora and near Mazatlán, Sinaloa, México.

• **Comment.** Very little has been written about *P. d. norrisi* aside from Smith and Langebartel's (1951) original description. The taxonomic status of specimens from northern Sonora and the relationships between *P. d. norrisi, P. d. nubilus,* and *P. d. perkinsi* in the same region deserve careful review. Hardy and McDiarmid (1969) reported an interesting specimen found near Mazatlán, Sinaloa. This snake most closely fit *P. d. norrisi* in both description and location. As Hardy and McDiarmid (1969) noted, that record extended the known range considerably southward. No other museum records were known between Mazatlán and the next known population to the north near Guaymas, Sonora. Recently, specimens have been reported from near Alamos, Navojoa, and Ciudad Obregon (Hale 1990), and about 35 mi NE of Ciudad Obregon (Ben E. Dial, pers. comm). This snake likely occurs in suitable habitat in northern Sinaloa.

4. *Phyllorhynchus decurtatus nubilus* Klauber Cloudy Leaf-nosed Snake

Phyllorhynchus decurtatus: Schmidt, 1922:685 (part).
Phyllorhynchus decurtatus browni: Linsdale, 1933:222 (part).
Phyllorhynchus decurtatus decurtatus: Klauber, 1935:9 (part).
Phyllorhynchus decurtatus nubilus Klauber, 1940:197. Type-locality, "Xavier (Weisner's Ranch), Pima County, Arizona." Holotype, San Diego Society of Natural History (SDSNH) 32493, an adult male collected by Lee Arnold on 16 July 1939 (examined by authors).
Phyllorhynchus decurtatus nubilis: Bogert and Oliver, 1945:350. Incorrect subsequent spelling.

• **Diagnosis.** This subspecies of Spotted Leaf-nosed Snake is distinguished by ventral scale counts of 157-162 in males and 171-176 in females; subcaudals 30-33 in males, 20-24 in females; and dorsal body blotches 42-60 with 7-15 tail blotches. This taxon is known from southcentral Arizona and northern Sonora.

• **Comment.** Some questions exist regarding the status of specimens referred to *P. d. nubilus* (see remarks above) and, assuming that this taxon is a recognizable subspecies, to its geographic distribution in Arizona and adjacent Sonora.

5. *Phyllorhynchus decurtatus perkinsi* Klauber Desert Leaf-nosed Snake

Phyllorhynchus decurtatus: Brown, 1901:64 (part).
Phyllorhynchus [decurtatus] [decurtatus]: Linsdale, 1933:222.
Phyllorhynchus decurtatus perkinsi Klauber, 1935:11. Type-locality, "Dry Lake, San Diego County, California." Holotype, San Diego Society of Natural History (SDSNH) 23757, an adult male collected by Laurence M. Klauber on 4 May 1935 (examined by authors).

• **Diagnosis.** This subspecies of Spotted Leaf-nosed Snake is characterized by ventral scale counts of 164-183 in males and 173-196 in females; subcaudals 32-42 in males, 24-34 in females; and dorsal body blotches 24-48 with 2-9 tail blotches. This taxon is the widest ranging of all the subspecies, occurring from southcentral California, southern Nevada, and central Arizona in the north to northern Baja

California Norte and northwestern Sonora in the south; also recorded from Isla Angel de la Guarda in the Gulf of California. Dry Lake is in the Lower Borrego Valley, on Highway 78, 3 mi west of the Imperial County line.

Literature Cited

Allyn, R. 1956. A dictionary of reptiles and amphibians. Great Outdoors Publ. Co., St. Petersburg, Florida.

Atsatt, S.R. 1921. A snake new to California. Copeia (96):38-39.

——. 1923. Behavior of the leaf-nosed snake, *Phyllorhynchus decurtatus*. Univ. California Publ. Zool. 21:303-312.

Baker, R.J., G.A. Mengden, and J.J. Bull. 1972. Karyotypic studies of thirty-eight species of North American snakes. Copeia 1972:257-265.

Banks, R.C., R.W. McDiarmid, and A.L. Gardner. 1987. Checklist of the vertebrates of the United States, the U.S. Territories, and Canada. Resource Publ. U.S. Fish Wildlife Ser. (166):ii + 79 p.

Banta, B.H. 1965. A distributional check list of the recent reptiles inhabiting the state of Nevada. Biol. Soc. Nevada Occ. Pap. 5:1-8.

Behler, J.L. and F.W. King. 1979. The Audubon society field guide to North American reptiles and amphibians. Alfred A. Knopf, New York.

Belding, L. 1887. Reptiles of the Cape region of Lower California. West Amer. Scient. 3:97-99.

Blanchard, F.N. 1925. A key to the snakes of the United States, Canada and Lower California. Pap. Michigan Acad. Sci. Arts Lett. 4(2): xiii + 65 p.

Bogert, C.M. 1939. Reptiles under the sun. Nat. Hist. 44:26-37.

—— and J.A. Oliver. 1945. A preliminary analysis of the herpetofauna of Sonora. Bull. Amer. Mus. Nat. Hist. 83:297-426.

Bostic, D.L. 1971. Herpetofauna of the Pacific coast of north central Baja California, Mexico, with a description of a new subspecies of *Phyllodactylus xanti*. Trans. San Diego Soc. Nat. Hist. 16:237-264.

Boulenger, G.A. 1893. Catalogue of the snakes in the British Museum (Natural History). Vol. 1. London.

Brattstrom, B.H. 1953. Notes on a population of leaf-nosed snakes, *Phyllorhynchus decurtatus perkinsi*. Herpetologica 9:57-64.

Brown, A.E. 1901. A review of the genera and species of American snakes, north of Mexico. Proc. Acad. Nat. Sci. Philadelphia 53: 10-110.

Browne, J.R. 1887. Resources of the Pacific Slope. New York (includes a section by W.M. Gabb titled *Exploration of Lower California*, p. 82-112) (cited in Nelson [1922], not seen by authors).

Bury, R.B., F. Gress, and G.C. Gorman. 1970. Karyotypic survey of some colubrid snakes from western North America. Herpetologica 26:461-466.

Cagle, F.R. 1957. Reptiles, pp. 273-358. *In* W.F. Blair, A.P. Blair, P. Brodkorb, F.R. Cagle, and G.A. Moore, Vertebrates of the United States. McGraw-Hill Book Co., Inc., New York.

Campbell, H.W. and S.P. Christman. 1982. The systematic status of *Phyllorhynchus decurtatus porelli* Powers and Banta. J. Herpetol. 16:182-183.

Cliff, F.S. 1954a. Variation and evolution of the reptiles inhabiting the islands in the Gulf of California, Mexico. Ph.D. diss, Stanford Univ., Stanford, California.

——. 1954b. Snakes of the islands in the Gulf of California, Mexico. Trans. San Diego Soc. Nat. Hist. 12:67-98.

Coborn, J. 1991. The atlas of snakes of the world. T.F.H. Publ., Neptune City, New Jersey.

Cochran, D.M. 1961. Type specimens of reptiles and amphibians in the United States National Museum. Bull. U.S. Natl. Mus. (220):xv + 291 p.

—— and C.J. Goin. 1970. The new field book of reptiles and amphibians. G.P. Putnam's Sons, New York.

Collins, J.T. 1990. Standard common and current scientific names for North American amphibians and reptiles. 3rd ed. Soc. Study Amph. Rept. Herpetol. Circ. (19):iii + 41 p.

——, J.E. Huheey, J.L. Knight, and H.M. Smith. 1978. Standard common and curent scientific names for North American amphibians and reptiles. Soc. Study Amph. Rept. Herpetol. Circ. (7):1-36.

——, R. Conant, J.E. Huheey, J.L. Knight, E.M. Rundquist, and H.M. Smith. 1982. Standard common and curent scientific names for North American amphibians and reptiles. 2nd ed. Soc. Study Amph. Rept. Herpetol. Circ. (12):1-28.

Conant, R., F.R. Cagle, C.J. Goin, C.H. Lowe, Jr., W.T. Neill, M.G. Netting, K.P. Schmidt, C.E. Shaw, R.C. Stebbins, and C.M. Bogert. 1956. Common names for North American amphibians and reptiles. Copeia 1956:172-185.

Cope, E.D. 1868. Sixth contribution to the herpetology of tropical America. Proc. Acad. Nat. Sci. Philadelphia 20:305-313.

——. 1875. Checklist of North American Batrachia and Reptilia. Bull. U.S. Natl. Mus. (1):1-104.

——. 1887. Catalogue of batrachians and reptiles of Central America and Mexico. Bull. U.S. Natl. Mus. (32):1-98.

——. 1892 (1891). A critical review of the characters and variations of the snakes of North America. Proc. U.S. Natl. Mus. 14:589-694.

——. 1900. The crocodilians, lizards, and snakes of North America. Ann. Rep. U.S. Natl. Mus. for 1898:153-1270 + 36 pl.

Cowles, R.B. 1941. Observations on the winter activities of desert reptiles. Ecology 22:125-140.

—— and C.M. Bogert. 1936. The herpetology of the Boulder Dam region (Nev., Ariz., Utah). Herpetologica 1:33-42.

—— and ——. 1944. A preliminary study of the thermal requirements of desert reptiles. Bull. Amer. Mus. Nat. Hist. 83:265-296.

Cuesta Terrón, C. 1920. Datos para una monografía sobre la fauna erpetológica de la península de la Baja California. Bol. Dir. Estud. Biol. 2:398-402.

Dial, B.E., P.J. Weldon, and B. Curtis. 1989. Chemosensory identification of snake predators (*Phyllorhynchus decurtatus*) by Banded Geckos (*Coleonyx variegatus*). J. Herpetol. 23:224-229.

Ditmars, R.L. 1907. The reptile book. Doubleday, Page & Company, New York.

——. 1912. The feeding habits of serpents. Zoologica (N.Y.) 1:197-238.

——. 1939. A field book of North American snakes. Doubleday, Doran & Co., Inc., New York.

——. 1951. The reptiles of North America. Doubleday & Co., Inc., Garden City, New York.

Fitch, H.S. 1970. Reproductive cycles in lizards and snakes. Univ. Kansas Mus. Nat. Hist. Misc. Publ. (52):1-247.

Fowlie, J.A. 1965. The snakes of Arizona. McGraw Hill Inc., New York.

Garman, S. 1884a (1883). The reptiles and batrachians of North America. Pt. 1. Ophidia-serpents. Mem. Mus. Comp. Zoöl. Harvard Univ. 8(3):xxxi + 185 p. + 9 pl.

——. 1884b. The North American reptiles and batrachians. A list of the species occurring north of the Isthmus of Tehuantepec, with references. Bull. Essex Inst. 16:1-46.

Gates, G.O. 1957. A study of the herpetofauna in the vicinity of Wickenburg, Maricopa County, Arizona. Trans. Kansas Acad. Sci. 60: 403-418.

Greene, H.W. 1988. Antipredator mechanisms in reptiles, pp. 1-152. *In* C. Gans and R.B. Huey (eds.), Biology of the Reptilia, Vol. 16, Ecology B, Defense and Life History. Alan R. Liss, New York.

Hahn, D.E. and C.J. May. 1972. Noteworthy Arizona herpetofaunal records. Herpetol. Rev. 4:91-92.

Hale, S. 1990. Alamos field trip 1989: trip notes. Part V. Tucson Herpetol. Soc. Newsl. 3(2):12-15.

Hardy, L.M. and R.W. McDiarmid. 1969. The amphibians and reptiles of Sinaloa, Mexico. Univ. Kansas Publ. Mus. Nat. Hist. 18(3):39-252.

Hensley, M.M. 1950. Results of a herpetological reconnaisance in extreme southwestern Arizona and adjacent Sonora, with a description of a new subspecies of the Sonoran whipsnake, *Masticophis bilineatus*. Trans. Kansas Acad. Sci. 53:270-288.

——. 1959. Albinism in North American amphibians and reptiles. Publ. Mus. Michigan St. Univ. 1:133-159.

Holman, J.A. 1981. A review of North American Pleistocene snakes. Publ. Mus. Michigan St. Univ., Paleontol. Ser. 1:261-306.

Kerfoot, W.C. 1969. Selection of an appropriate index for the study of the variability of lizard and snake body scale counts. Syst. Zool. 18:53-62.

——. 1970. The effect of functional changes upon the variability of lizard and snake body scale numbers. Copeia 1970:252-260.

Klauber, L.M. 1924. Notes on the distribution of snakes in San Diego County, California. Bull. Zool. Soc. San Diego (1):1-26.

——. 1930. A list of the amphibians and reptiles of San Diego County, California. Bull. Zool. Soc. San Diego (5):1-7.

——. 1931. A statistical survey of snakes of the southern border of California. Bull. Zool. Soc. San Diego (8):1-93.

——. 1932. Amphibians and reptiles observed enroute to Hoover Dam. Copeia 1932:118-128.

——. 1934. Annotated list of the amphibians and reptiles of the south-

ern border of California. Bull. Zool. Soc. San Diego (11):1-28.
——. 1935. *Phyllorhynchus*, the leaf-nosed snake. Bull. Zool. Soc. San Diego (12):1-31.
——. 1939. Studies of reptile life in the arid southwest. Bull. Zool. Soc. San Diego (14):1-100.
——. 1940. Two new sub-species of *Phyllorhynchus*, the leaf-nosed snake, with notes on the genus. Trans. San Diego Soc. Nat. Hist. 9:195-214.
——. 1941a. The frequency distributions of certain herpetological variables. Bull. Zool. Soc. San Diego (17):1-31.
——. 1941b. Illustrations of the relationship between populations and samples. Bull. Zool. Soc. San Diego (17):33-71.
——. 1943. Tail-length differences in snakes with notes on sexual dimorphism and the coefficient of divergence. Bull. Zool. Soc. San Diego (18):1-60.
——. 1945. Herpetological correlations. I. Correlations in homogeneous populations. Bull. Zool. Soc. San Diego (21):1-101.
——. 1956. Rattlesnakes: their habits, life histories, and influence on mankind. Univ. California Press, Berkeley.
Kluge, A.G. 1984. Type-specimens of reptiles in the University of Michigan Museum of Zoology. Misc. Publ. Mus. Zool. Univ. Michigan (167):1-85.
Langebartel, D.A. and H.M. Smith. 1954. Summary of the Norris collection of reptiles and amphibians from Sonora, Mexico. Herpetologica 10:125-136.
Leviton, A.E. 1971. Reptiles and amphibians of North America. Doubleday & Co., Inc., New York.
—— and B.H. Banta. 1956. Catalogue of the amphibian and reptile types in the natural history museum of Stanford University. Suppl. no. 1. Herpetologica 12:213-219.
—— and ——. 1964. Midwinter reconnaissance of the herpetofauna of the Cape region of Baja California, Mexico. Proc. California Acad. Sci. (4), 30:127-156.
Lindsay, G.E. 1964. Sea of Cortez expedition of the California Academy of Sciences. Proc. California Acad. Sci. 30:211-242.
Linsdale, J.M. 1932. Amphibians and reptiles from Lower California. Univ. California Publ. Zool. 38:345-386.
——. 1933. The leaf-nosed snake in Sonora, Mexico. Copeia 1933:222-223.
Lowe, C.H. 1964. The vertebrates of Arizona. Univ. Arizona Press, Tucson.
Marx, H. and G.B. Rabb. 1972. Phyletic analysis of fifty characters of advanced snakes. Fieldiana Zool. 63:viii + 321 p.
McCoy, C.J., Jr. 1964. Notes on snakes from northern Mexico. Southwest. Nat. 9:46-48.
Medden, R.V. 1927. Notes on *Phyllorhynchus*. Copeia (164):82-83.
Miller, A.H. and R.C. Stebbins. 1964. The lives of desert animals in Joshua Tree National Monument. Univ. California Press, Berkeley.
Mosauer, W. 1936. The reptilian fauna of sand dune areas of the Vizcaino desert and of northwestern Lower California. Occ. Pap. Mus. Zool. Univ. Michigan (329):1-21.
Murphy, R.W. 1983. The reptiles: origin and evolution, pp. 130-158. *In* T.J. Case and M.L. Cody (eds.), Island biogeography in the Sea of Cortez. Univ. California Press, Berkeley.
—— and J.R. Ottley. 1980. A genetic evaluation of the leaf-nosed snake, *Phyllorhyncbus arenicolus*. J. Herpetol. 14:263-268.
Murray, K.F. 1955. Herpetological collections from Baja California. Herpetologica 11:33-48.
Neill, W.T. 1958. The occurance of amphibians and reptiles in salt water areas, and a bibliography. Bull. Marine Sci. Gulf Carib. 8:1-97.
Nelson, E.W. 1922. Lower California and its natural resources. Mem. Natl. Acad. Sci. 16:1-194.
Obst, F.J., K. Richter, and U. Jacob. 1988. The completely illustrated atlas of reptiles and amphibians for the terrarium. T.F.H. Publ., Neptune City, New Jersey.
Perkins, C.B. 1940. A key to the snakes of the United States. Bull. Zool. Soc. San Diego (16):1-63.
——. 1949a. The snakes of San Diego County with descriptions and key. Bull. Zool. Soc. San Diego (23):1-77.
——. 1949b. A key to the snakes of the United States. 2nd ed. Bull. Zool. Soc. San Diego (24):1-79.
Peters, J.A. 1952. Catalogue of type specimens in the herpetological collections of the University of Michigan Museum of Zoology. Occ. Pap. Mus. Zool. Univ. Michigan (539):1-55.
Pickwell, G.B. 1947. Amphibians and reptiles of the Pacific states. Stanford Univ. Press, Stanford, California.
Powers, A.L. and B.H. Banta. 1974. Description of a *Phyllorhynchus* from Cerralvo Island, Gulf of California, Mexico. Great Basin Nat. 34:241-244.
Saint-Girons, H. and M.-C. Saint-Girons. 1956. Cycle d'activitie et thermoregulation chez les reptiles (lezards et serpentes). Vie et Milieu 7:133-226.
Savage, J.M. 1948. An illustrated key to lizards, snakes, and turtles of California. Naturegraph Pocket Keys, Los Altos, California.
——. 1949. An illustrated key to the lizards, snakes, and turtles of the western United States and Canada. Naturegraph Pocket Keys, Los Altos, California.
——. 1960. Evolution of a peninsular herpetofauna. Syst. Zool. 9:184-212.
—— and F.S. Cliff. 1954. A new snake, *Phyllorhynchus arenicola*, from the Gulf of California, Mexico. Proc. Biol. Soc. Washington 67:69-75.
Schmidt, K.P. 1922. The amphibians and reptiles of Lower California and the neighboring islands. Bull. Amer. Mus. Nat. Hist. 46:607-707.
——. 1953. A checklist of North American amphibians and reptiles. 6th ed. Amer. Soc. Ichthyol. Herpetol. Univ. Chicago Press, Chicago, Illinois.
—— and D.D. Davis. 1941. Field book of snakes of the United States and Canada. G.P. Putnam's Sons, New York.
Seib, R.L. 1980. Baja CAlifornia: a peninsula for rodents but not for reptiles. Amer. Nat. 115:613-620.
Shaw, C.E. and S. Campbell. 1974. Snakes of the American west. Alfred A. Knopf, New York.
Simon, H. 1979. Easy identification guide to North American snakes. Dodd, Mead & Co., New York.
Slevin, J.R. 1931. Range extensions of certain western species of reptiles and amphibians. Copeia 1931:140-141.
Sloan, A.J. 1965. Holotype specimens of reptiles in the collection of the San Diego Society of Natural History. Trans. San Diego Soc. Nat. Hist. 14:1-8.
Smith, H.M. and D.A. Langebartel. 1951. A new geographic race of leaf-nosed snake from Sonora, Mexico. Herpetologica 7:181-184.
——, ——, and K.L. Williams. 1964. Herpetological type specimens in the University of Illinois Museum of Natural History. Illinois Biol. Monogr. (32):1-80.
—— and R.B. Smith. 1976. Synopsis of the herpetofauna of Mexico. Vol 3. Source analysis and index for Mexican reptiles. John Johnson, North Bennington, Vermont.
—— and E.H. Taylor. 1945. An annotated checklist and key to the snakes of Mexico. Bull. U.S. Natl. Mus. (187):iv + 239 p.
—— and ——. 1950. Type localities of Mexican reptiles and amphibians. Univ. Kansas Sci. Bull. 33:313-380.
Smith, P.W. and M.M. Hensley. 1958. Notes on a small collection of amphibians and reptiles from the vicinity of the Pinacate lava cap in northwestern Sonora, Mexico. Trans. Kansas Acad. Sci. 61:64-76.
Soulé, M. and A.J. Sloan. 1966. Biogeography and distribution of the reptiles and amphibians on islands in the Gulf of California, Mexico. Trans. San Diego Soc. Nat. Hist. 14:137-156.
Spector, W.S. 1956. Handbook of biological data. W.B. Saunders Co., Philadelphia.
Stebbins, R.C. 1954. Amphibians and reptiles of western North America. McGraw-Hill Book Co., New York.
——. 1966. A field guide to western reptiles and amphibians. Houghton Mifflin Co., Boston.
——. 1972. Amphibians and reptiles of California. Univ. California Press, Berkeley.
——. 1985. A field guide to western reptiles and amphibians. 2nd ed., rev. Houghton Mifflin Co., Boston.
Stejneger, L. 1890. On a new genus and species of colubrine snakes from North America. Proc. U.S. Natl. Mus. 13:151-155.
—— and T. Barbour. 1917. A checklist of North American amphibians and reptiles. Harvard Univ. Press, Cambridge, Massachusetts.
—— and ——. 1923. A checklist of North American amphibians and reptiles. 2nd ed. Harvard Univ. Press, Cambridge, Massachusetts.
—— and ——. 1933. A checklist of North American amphibians and reptiles. 3rd ed. Harvard Univ. Press, Cambridge, Massachusetts.
—— and ——. 1939. A checklist of North American amphibians and reptiles. 4th ed. Harvard Univ. Press, Cambridge, Massachusetts.

—— and ——. 1943. A checklist of North American amphibians and reptiles. 5th ed. Bull. Mus. Comp. Zoöl. 93:xix + 260 p.
Tanner, W.W. 1969. New records and distribution notes for reptiles of the Nevada test site. Great Basin Nat. 29:31-34.
Taylor, E.H. 1936. Notes on the herpetological fauna of the Mexican state of Sonora. Univ. Kansas Sci. Bull. 37:475-503.
Trinco, L.A. and H.M. Smith. 1972. The karyology of ophidians: a review. Trans. Kansas Acad. Sci. 74:138-146.
Turner, F.B. and R.H. Wauer. 1963. A survey of the herpetofauna of the Death Valley area. Great Basin Nat. 23:119-128.
Underwood, G. 1967. A contribution to the classification of snakes. Trustees Brit. Mus. (Nat. Hist.), London.
Van Denburgh, J. 1895. A review of the herpetology of Lower California. Pt. 1 - Reptiles. Proc. California Acad. Sci. (2), 5:77-162 + 11 pl.
——. 1922. The reptiles of western North America. Vol. 2. Snakes and turtles. Occ. Pap. California Acad. Sci. (10):613-1028 + 71 pl.
—— and J.R. Slevin. 1921. A list of the amphibians and reptiles of the peninsula of Lower California, with notes on the species in the collection of the Academy. Proc. California Acad. Sci. (4), 11:49-72.
Van Devender, T.R. and J.I. Mead. 1978. Early Holocene and Late Pleistocene amphibians and reptiles in Sonoran Desert packrat middens. Copeia 1978:464-475.
Vitt, L.J. and R.D. Ohmart. 1978. Herpetofauna of the Lower Colorado River: Davis Dam to the Mexican border. Proc. West. Found. Vert. Zool. 2(2):33-72.
—— and A.C. Hulse. 1973. Observations on feeding habits and tail display of the Sonoran coral snake, *Micruroides euryxanthus*. Herpetologica 29:302-304.
Vorhies, C.T. 1926. Notes on some uncommon snakes of southern Arizona. Copeia (157):158-160.
Weaver, W.G., Jr. 1965. The cranial anatomy of the hog-nosed snakes (*Heterodon*). Bull. Florida State Mus. Biol. Sci. 9:275-304.
Welsh, H.H., Jr. 1988. An ecogeographic analysis of the herpetofauna of the Sierra San Pedro Martir region, Baja California, with a contribution to the biogeography of the Baja California herpetofauna. Proc. California Acad. Sci. 46:1-72.
—— and R.B. Bury. 1984. Additions to the herpetofauna of the south Colorado Desert, Baja California, with comments on the relationships of *Lichanura trivirgata*. Herpetol. Rev. 15:53-56.
Wright, A.H. and A.A. Wright. 1952. List of the snakes of the United States and Canada by states and provinces. Amer. Midl. Nat. 48: 574-603.
—— and ——. 1957. Handbook of the snakes of the United States and Canada. Comstock Publ. Assoc., Ithaca, New York.
Yarrow, H.C. 1882. Checklist of North American Reptilia and Batrachia, with catalogue of specimens in U.S. National Museum. Bull. U.S. Natl. Mus. (24):1-249.
Yingling, P. 1991. Leaf-nosed snake, genus *Phyllorhynchus*. San Diego Herpetol. Soc. 13(2):1-2.
Zweifel, R.G. and K.S. Norris. 1955. Contribution to the herpetology of Sonora, Mexico: description of new subspecies of snakes (*Micruroides euryxanthus* and *Lampropeltis getulus*) and miscellaneous collecting notes. Amer. Midl. Nat. 54:230-249.

Ryan J.R. McCleary, Department of Biology, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061, and **Roy W. McDiarmid**, National Biological Survey, National Museum of Natural History, Smithsonian Institution, Washington, DC 20560-0111.

Primary editor for this account, Larry David Wilson.

Published 30 November 1993 and Copyright © 1993 by the Society for the Study of Amphibians and Reptiles.